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Dr. Middleton PHYS 132 HW
3-1-17 Ch.30

CQ: 11
P: 28, 34, 58

Problems

30.P.28

A) 2.0m Gold Wire, $D = 2.0\times10^{-4}m$

a.) R? $R = \frac{\rho L}{A}$ $A = \pi(1.0\times10^{-4}m)^2$

$A = \pi 1.0\times10^{-8}m^2$

$L = 2.0m$

$A = \pi 1.0\times10^{-8}m^2$

$\rho = 2.4\times10^{-8}(\Omega m)$

$R = \frac{2.4\times10^{-8}\Omega m(2.0m)}{\pi(1.0\times10^{-8}m^2)}$

$R = 1.53\Omega$

B) $10\times10^{-2}m$ Long Carbon Piece 1.0mm × 1.0mm

b.) R? $R = \frac{\rho L}{A}$ $(1.0\times10^{-3}m)^2$

$L = 10\times10^{-2}m$

$A = 1.0\times10^{-6}m^2$

$\rho = 3.5\times10^{-5}\Omega m$

$R = \frac{(3.5\times10^{-5}\Omega m)(10\times10^{-2}m)}{(1.0\times10^{-6}m^2)}$

$R = 3.5\Omega m$

A.) $R = 1.53\Omega$
B.) $R = 3.5\Omega$

30.P.34

$\Delta V = 9.0V$
$D = 7.0\times10^{-4}m$
$L = 6.0\times10^{-2}m$

$I = \frac{\Delta V}{R}$ $R = \frac{\rho L}{A}$

$I = \frac{9.0V}{5.46\Omega}$

$I = 1.64A$

$R = 5.46\Omega$
$\Delta V = 9.0V$
$\rho = 3.5\times10^{-5}\Omega m$
$L = 6.0\times10^{-2}m$
$A = (1.225\times10^{-7}m^2)\pi$

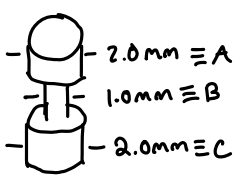
$A = \pi r^2$
$= \pi(3.5\times10^{-4}m)^2$
$A = (1.225\times10^{-7}m^2)\pi$

$R = \frac{(3.5\times10^{-5}\Omega m)(6.0\times10^{-2}m)}{\pi(1.225\times10^{-7}m^2)}$

$R = 5.46\Omega$

$I = 1.64A$

30.P.58



Aluminum

Due to Symmetry
A=C

A.) a. $I = 10A$

b. $J = I/A$ $J = \frac{10A}{\pi(1.0\times10^{-6}m^2)}$

$I = 10A$ $J = 3.18\times10^{6}A/m^2$

$A = \pi(1.0\times10^{-6}m^2)$

c. $E = J/\sigma$ $J = 3.18\times10^{6}A/m^2$

$\sigma_{Al} = 3.5\times10^{7}\Omega^{-1}m^{-1}$

$E = (3.18\times10^{6}A/m^2)/(3.5\times10^{7}\Omega^{-1}m^{-1})$

$E = 0.091\ V/m$

d. $v_d = \frac{J}{nee}$ $v_d = 3.3\times10^{-4}m/s$

$J = 3.18\times10^{6}A/m^2$

$n_e = 6.0\times10^{28}m^{-3}$

$e = 1.602\times10^{-19}C$

e. $i_e = I/e$ $i_e = 10A/1.602\times10^{-19}C$

$I = 10A$

$e = 1.602\times10^{-19}C$ $i_e = 6.24\times10^{19}A/C$

B.) a. $I = 10A$

b. $J = I/A$ $\quad J = 10A/\pi(0.5\times10^{-3}m)^2$

$I = 10A$

$A = \pi(0.6\times10^{-3}m)^2$ $\quad J = 1.27\times10^{7} A/m^2$

c. $E = J/\sigma$ $\quad E = 1.27\times10^{7}A/m^2 / 3.5\times10^{7}\Omega^{-1}m^{-1}$

$J = 1.27\times10^{7} A/m^2$ $\quad E = 0.36\ V/m$

$\sigma = 3.5\times10^{7}\Omega^{-1}m^{-1}$

d. $V_d = \frac{J}{nee}$ $\quad V_d = \frac{1.27\times10^{7}A/m^2}{(6.0\times10^{28}m^{-3})(1.602\times10^{-19}C)}$

$J = 1.27\times10^{7}A/m^2$ $\quad V_d = 1.32\times10^{-3}m/s$

$ne = 6.0\times10^{28}m^{-3}$

$e = 1.602\times10^{-19}C$

e. $i_e = I/e$ $\quad$ same for A & C

$I = 10A$ $\quad i_e = 6.24\times10^{19}A/C$

$e = 1.602\times10^{-19}C$

	I	J	E	V_d	i_e
A	10 A	$3.18\times10^{6}A/m^2$	0.091 V/m	$3.3\times10^{-4}m/s$	$6.24\times10^{19}A/C$
B	10 A	$1.27\times10^{7}A/m^2$	0.36 V/m	$1.32\times10^{-3}m/s$	$6.24\times10^{19}A/C$
C	10 A	$3.18\times10^{6}A/m^2$	0.091 V/m	$3.3\times10^{-4}m/s$	$6.24\times10^{19}A/C$

Conceptual

30.C.11

$R = \frac{\rho L}{A}$ $\quad$ A) $R_A = \frac{\rho L}{\pi r^2}$ $\quad$ B) $R_B = \frac{\rho L}{4\pi r^2}$ $\quad$ C) $R_C = \frac{\rho 2L}{4\pi r^2} = \frac{\rho L}{2\pi r^2}$

ρ = same for all $\quad$ D) $R_D = \frac{\rho 2L}{\pi r^2}$ $\quad$ E) $R_E = \frac{\rho 4L}{4\pi r^2} = \frac{\rho L}{\pi r^2}$

$R_D > R_A = R_E > R_C > R_B$